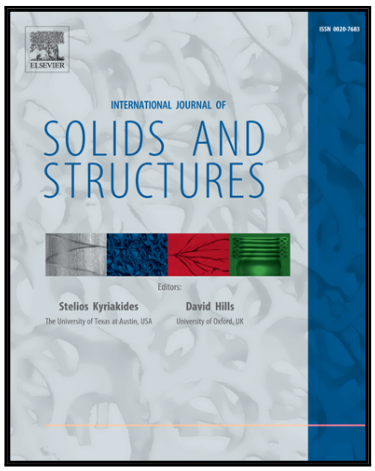

Exact equilibrium solutions for nonlinear spatial deformations of nanorods with application to buckling under terminal force and couple

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Exact equilibrium solutions for nonlinear spatial deformations of nanorods with application to buckling under terminal force and couple

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Abstract

The paper is concerned with nonlinear spatial deformations of nanorods, described by exact solutions of the equilibrium equations of a rod theory based on the kinematics of Kirchhoff's inextensible rods and the constitutive equation of Eringen's nonlocal materials. The nonlinear equilibrium equations of nonlocal elastic rods that are prismatic in a natural state are established and their solutions are obtained for both configurations in which the axial curve has constant curvature and torsion, and general configurations in which the axial curve is described by means of elliptic functions. As an example of application of the theory, the buckling in space under terminal force and couple of nonlocal rods with one end clamped and the other one constrained to have the tangent parallel to the direction of the undeformed rod axis, is examined. For such rods, the eigencurves corresponding to bifurcation from configurations in which the axial curve is straight are found, and the exact solutions for the post-buckling configurations are presented. The results show that, along bifurcating branches on which the axial force is constant the rods, through a sequence of spatial equilibrium configurations, arrive at configurations in

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